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Engaging undergraduate students in hadron physics research and instrumentation[1]

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Nuclear physics research is fundamental to our understanding of the visible universe and at the same time intertwined with our daily life. Nuclear physics studies the origin and structure of the atomic nuclei in terms of their basic constituents, the quarks and gluons. Atoms and molecules would not exist without underlying quark-gluon interactions, which build nearly all the mass of the visible universe from an assembly of massless gluons and nearly-massless quarks. The study of hadron structure with electromagnetic probes through exclusive and semi-inclusive scattering experiments carried out at the 12 GeV Jefferson Laboratory plays an important role in this effort. In particular, planned precision measurements of pion and kaon form factors and longitudinal-transverse separated deep exclusive pion and kaon electroproduction cross sections to the highest momentum transfers achievable play an important role in understanding hadron structure and masses and provide essential constraints for 3D hadron imaging. While a growing fraction of nuclear physics research is carried out at large international laboratories, individual university research groups play critical roles in the success of that research. These include data analysis projects and the development of state-of-the-art instrumentation demanded by increasingly sophisticated experiments. These efforts are empowered by the creativity of university faculty, staff, postdocs, and provide students with unique hands-on experience. As an example, an aerogel Cherenkov detector enabling strangeness physics research in Hall C at Jefferson Lab was constructed at the Catholic University of America with the help of 16 undergraduate and high school students. The "Conference Experience for Undergraduates" (CEU) provides a venue for these students who have conducted research in nuclear physics. This presentation will present the experiences of one of the participants in the first years of the CEU, her current research program in hadronic physics, and her current and former students who have been participating in more recent CEU events.

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